Reaching for Yield and the Diabolic Loop in a Monetary Union ⋆

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Abstract

We build on Acharya and Naqvi (2019) to introduce a macro-financial model where the "reach for yield" incentivized by a loosening monetary policy in the United States mitigates the diabolic loop in a Monetary Union. We provide empirical evidence that the introduction of an accommodative monetary policy by the Fed lowers the yields in US assets, increases liquidity and by extension the threshold above which a liquidity shock can damage a bank. This, in turn, incentivizes bank managers to optimize their portfolios by investing in risky assets. We use a monetary VAR to provide novel empirical evidence that there is an increase in the flow of funds to European assets, a result which can be attributed to the "reach for yield" incentive. This portfolio balance channel attenuates the effects of financial fragility, improves government funding costs, and credit conditions by providing liquidity to domestic banks and assets. As a result, the "reaching for yield" incentive mitigates the diabolic loop effect.

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1. Introduction

"*The economy has slowed to a virtual standstill, underlying concerns over the country's growth prospects. Italian banks are directly exposed through their holdings of sovereign debt. Italian bank shares were also hit after the Fitch credit rating agency said banks' balance sheets were under pressure because of their exposure to Italian government debt. The vicious link between sovereigns and banks has not been cut.*"

- Bank of Italy[1]

The global financial crisis of 2008-2009, which metastasized to the euro area crisis, brought into light a fierce controversial debate among academics and policymakers on the effectiveness of fiscal stimulus policies. Many governments in the euro area intervened to bail out troubled banks. As a result, some of the core euro area countries, which previously had low or adequate levels of debt to GDP such as France, Italy and Spain, experienced a spiraling sovereign debt and unprecedented fiscal deficits in the midst of an economic recession. The rise in sovereign credit risk is costly because it destroys the balance sheet of domestic banks, as shown in Gennaioli, Martin and Rossi (2014). This vicious circle of banks hurting sovereigns and, in turn, sovereigns hurting banks is called the "sovereign-bank diabolic loop", and the first empirical evidence of its existence was found by Acharya, Drechsler and Schnabl (2014).[2] As a response, these countries followed a fiscal tightening policy (austerity) to stimulate growth, which however caused either a contraction to the output or at best an anemic economic recovery. An intriguing question is thus whether there is a way to mitigate the diabolic loop.

While several studies have developed new macroeconomic models to study the interaction between sovereign debt, fiscal stimulus and bank bailouts (Gertler and Kiyotaki, 2010;

[1] Remarks made by the Bank of Italy governor, Salvatore Rossi, in his two speeches that were extensively discussed in the Financial Times on September 6 and October 20, 2018 with the title "Banks are Italy's Achilles heel in battle to lift feeble sentiment" and "Italy's central bank warns of slowdown", respectively.

[2] As mentioned in the work of Cooper and Nikolov (2018), the term "diabolic loop" was coined by Markus Brunnermeier in a presentation on the Euro Crisis at the July 2012 NBER Summer Institute.

Gertler and Karadi, 2011; Gertler, Kiyotaki and Queralto, 2012; Kirchner and van Wijnbergen, 2016; Cooper and Nikolov, 2018), the literature has not found a solution to this puzzle which was accentuated by the failure of fiscal stimulus programs in the Eurozone to produce robust growth. For instance, Kiyotaki and Queralto (2012) investigate the effectiveness of expansionary fiscal policies funded through a healthy financial sector during an economic recession and show that bank's risk-taking incentives could reduce the benefit of governmental credit policies aiming to stabilize the financial markets. Kirchner and van Wijnbergen (2016) propose a macroeconomic model with fiscal deficits being fully funded by a distressed financial sector which, in turn, exacerbates financial fragility due to the deterioration of banks' balance sheets. This condition, as modelled also in Cooper and Nikolov (2018), contributes to a belief that government default is increasingly likely to hurt banks' balance sheets through banks' sovereign debt holdings. As a result, when banks are heavily invested in sovereign debt, the effectiveness of fiscal stimulus is attenuated, and the diabolic loop comes into effect.

In this article, we show that international spillovers generated by a loosening US monetary policy have an important effect on the European economies through the "reach for yield" phenomenon, which transmits from the portfolio rebalancing channel.[3] Our rationale relies on the fact that in theory, the incentive of banks to invest in riskier assets and to achieve higher yields increases significantly in a low interest rate environment where banks have access to abundant liquidity (Rajan 2006; Martinez-Miera and Repullo 2017). In a similar spirit, Fratzscher, Lo Duca and Straub (2018) report that international spillovers of US quantitative

[3] An additional reason motivating the introduction of this hypothesis is that, the US holdings of foreign long-term assets have consistently increased since 1994 according to the 2015 report of the US Department of the Treasury on US Portfolio Holdings of Foreign Securities, except a significant fall in 2008 by 40% from the 2007 level to 4.3 trillion. The same report shows that, in terms of market value, the US investors hold the most foreign securities from European countries (47%), of which 24% from the euro area countries. As of December 2015, they also hold 300 billion of long-term and short-term securities (including both private and government securities) of the four euro area countries under consideration (France, Germany, Italy and Spain), or about 11% of the total market value of the US holdings of foreign securities.

easing affect emerging markets, while Acharya and Naqvi (2019) introduce a model of financial intermediation whereby the "reach for yield" incentivizes banks to invest in riskier assets. Building on these papers, we introduce a macro-financial model where banks optimize their portfolios by investing in riskier assets, such as European banks and sovereign bonds, which have high default risk and yields due to the diabolic loop effect. This, in turn, provides liquidity to the local banking system and mitigates the diabolic loop effect in the monetary union.

More concretely, we study how the loosening monetary policy followed by the Federal Reserve, affected domestic US assets, resulted to a rebalancing towards non-US assets, and in particular into European assets via an increase in banks' risk-taking incentives. To understand the "reaching for yield" incentive for banks, we build a model similar in spirit to the agency problem inside banks proposed by Acharya and Naqvi (2019) and the banks' incentive problem introduced by Stein (2002). The asset portfolio of banks consists of sovereign bonds and loans, while their overall portfolio size depends on the capital ratio and access to liquidity. According to the model monetary loosening policy increases the pool of liquidity available to banks.

Next, we show empirically how the expansion of the Federal Reserve's balance sheet via quantitative easing (QE) reduces Treasury yields. As shown by Fratzscher, Lo Duca, and Straub (2018), this condition of low expected return contributes to a rebalancing of flows towards non-US assets. In a similar vein, our study shows that quantitative easing was associated with an increase of flows towards European high yield assets, an outcome which can be attributed at the "reach for yield" incentive. We show that when the European governments adopt a fiscal stimulus policy, this portfolio flow channel attenuates the effects of financial fragility in the domestic banking sector, and as a result, euro area governments find access to finance their deficit policies. Therefore, the "reaching for yield" incentive mitigates the diabolic loop effect.

At the empirical stage, we employ a monetary VAR à la Gertler and Karadi (2015) model by using data from the four biggest euro area countries (France, Germany, Italy and Spain) to identify the effect of the US monetary policy shocks on domestic assets as well as on the transmission of monetary policy through the portfolio balance channel. Our approach starts with the traditional money shock Vector Autoregression (VAR) analysis as developed by Bernanke and Blinder (1992), and Christiano, Eichenbaum and Evans (1996). In the second step, we identify the effects of monetary shocks by using the unexpected changes in the Federal funds rate and LIBOR futures on Federal Open Market Committee (FOMC) dates in order to capture policy surprises as external instruments in the VAR model. This step is similar to Kuttner (2001), Gürkaynak, Sack, and Wright (2007).

Our results show that unconventional monetary policies used by the Federal Reserve, such as the expansion of the balance sheet through QE measures, decrease the U.S. Treasury yields and the credit costs. As mentioned by Bernanke (2005) and modelled by Martinez-Miera and Repullo (2017), this policy generates incentives to "search for yield" and increase the risk-taking of US banks. Moreover, the portfolio balance channel is found to contribute to the reduction of both the euro area sovereign bond rates (i.e., the cost of borrowing for governments) and credit costs (i.e. the credit default swaps), leading to better conditions to raise equity in the banking sector. This result indicates that financial fragility and the diabolic loop can be mitigated by the portfolio balance channel.

Our paper is closely related to a recent literature investigating the implications of bailouts when banks hold large exposures of sovereign bonds (i.e., the "diabolic loop") and the consequences on sovereign default (Acharya, Drechsler, and Schnabl 2014; Broner et al. 2014; Gennaioli, Martin, and Rossi 2014; van der Kwaak and van Wijnbergen 2014). We particularly contribute to this literature by showing how proposing a solution to the diabolic loop puzzle, which is the impact of the portfolio balance channel on mitigating banking fragility and on reducing the borrowing costs for governments. The theoretical model also contributes on the works of Acharya and Naqvi (2019), and Stein (2002), who show how the "reach for yield" incentive affects banks' decisions, by introducing an incentive to invest in risky or in safe assets, rather than to provide risky or safe loans.

The remainder of the article is organized as follows. Section 2 reviews the related literature. Section 3 presents the theoretical and the econometric framework. Section 4 discusses the dataset and calibrates the models. Section 5 provides some concluding remarks.

2. Literature review

2.1 The "diabolic loop"

The global financial crisis (GFC) of 2008 was associated with many government interventions to rescue troubled banks. As such, the interaction between a distressed financial sector which induces government bailouts which in turn increases sovereign risk and weakens the financial sector became the subject of a growing literature. According to the traditional financial intermediation theory, domestic banks in developed countries hold government bonds as a way to store liquidity and as a safe riskless investment (Holmstrom and Tirole, 1993). Prior to the GFC, the sovereign debt of developed countries was treated as a "free lunch" investment, since the risk of default was unlikely to be of any concern. Yet, nowadays sovereign credit risk is a significant problem for many countries and, most notably for European countries. Demirguc-Kunt and Huizinga (2013) are among the first authors who study the effect of bank bailouts on international sovereign credit risk measured by equity prices and credit default swap rates. They show that, in contrast with the conventional wisdom, some large banks may actually be too big to save rather than too big to fail.

Acharya, Drechsler and Schnabl (2014) provide empirical evidence for the interaction between sovereign and bank balance sheets. They document the existence of a sovereign-bank loop in which government interventions and bank balance sheet holdings of sovereign debt cause a significant increase in their highly correlated default probabilities. Gennaioli, Martin, and Rossi (2014) show that domestic banks hold a significant share of their assets in government bonds which serve as a government commitment against strategic sovereign default. This is the case because if governments choose to default on their debt held by domestic banks this will increase credit costs and default probabilities for the banks. Since selective default is impossible, this will increase the amount of debt the government can credibly promise to repay.

More recently, Cooper and Nikolov (2018) study the conditions for the existence of the diabolic loop. They find that equity issuance plays an important role on whether the sovereign-bank loop is a Nash equilibrium. When banks can issue equity, the diabolic loop does not exist. On the contrary, in equilibrium conditions, banks have rational expectations of a government bailout, and therefore they do not issue equity. As a result, governments intervene to rescue troubles banks, and this leads to an increase in the likelihood or belief of sovereign default, which in turn hurts the balance sheet of banks. It is clear that the extant literature provides both theoretical and empirical evidence for the existence of the diabolic loop. Yet, none of the previous studies propose a solution to mitigate the diabolic loop puzzle.

2.2 The portfolio balance channel

Since the GFC of 2008-2009 and the implementation of unconventional monetary policies by central banks of core advanced economies, numerous studies provide strong empirical evidence for the effect of loosening policies on financial assets and markets. For example, Neely (2015) and Tillman (2016) study expansionary unconventional policies and show that quantitative easing policies have considerable spillover effects on international markets and most notably on emerging equity markets. Bernhard and Ebner (2017) document that unconventional policies had large effects on asset prices in Switzerland. Bauer and Neely (2014) emphasize on the role of the US dollar depreciation regarding international asset prices and find that unconventional policies reduce international long-term bond yields and the value of the dollar even at the zero-lower bound. Similarly, Bowman, Londono and Sapriza (2015) find that country-specific characteristics in the emerging market economies, such as the volatility of the domestic currency, play an important role on the response of asset prices to monetary policy shocks.

An important explanation for the above-mentioned effect is the declining response of the yields on short- and long-term government and corporate bonds, which incentivizes an increase in fund flows to assets that offer higher yields (Glick and Leduc, 2012). Indeed, Fratzcher, Lo Duca and Straub (2016) provide evidence that unconventional monetary policies are transmitted internationally through the portfolio balance channel. Large scale asset and quantitative easing purchases affect asset prices, consistent with the results of D'Amico and King (2013) and, put the portfolio balance channel into work. To explain the size of the spillover effect, three important factors: i) the specific characteristics of the unconventional policy measures implemented by the central bank; ii) the degree of global financial and economic integration; and iii) the presence of imperfection in the domestic business cycle. Related to this literature, our study provides novel evidence for the effect of unconventional monetary policy on specific euro area assets and economies through the portfolio balance channel.

3. The model

3.1 The theoretical economic framework

This section describes the core framework to model an economy in which the interaction between a loosening monetary policy and the reaching for yield incentive via financial intermediation will be studied. Our model builds on the works of Acharya and Naqvi (2019), and Stein (2002). To these we add investment funds that banks can use to make safe and risky investments domestically and abroad. We thus extend these works by introducing an incentive to invest in risky or in safe assets rather than to provide risky or safe loans.

More concretely, we consider a two-sector economy with a private banking sector and a public sector (i.e., monetary authority) with I number of investors within a three time-period framework. Each investor is risk-neutral at $t = 0$ and deposits an endowment of 1 unit in the bank. The endowment deposited by investors is thus interpreted as the "liquidity" available to the bank. Under a loosening monetary policy and similar to Kashyap and Stein (1995), banks' liquidity increases and the available funds for investments rise as they constitute a function of monetary policy. Accordingly, in a monetary tightening environment the yield on the Treasury bill increases, whilst in a loosening policy the yield decreases, such that $I^{'}(T_b) < 0$, with T_b interpreted as the yield in the Treasury bill.

The bank has the choice to invest the available funds in safe or in risky projects, where safe projects are investments in US Treasury yields and risky projects are investments in projects that offer an expected return higher than the US Treasury yields. The return from this investment is realized at $t = 2$, and the payoff for the risky project is π_R and for the safe project is π_S . The bank also faces two situations: a period with ample liquidity with probability L or a period where liquidity evaporates with probability $1 - L$. If the bank invests during the period of ample liquidity, the probability that the risky project will succeed is p. Therefore, the payoff distribution for the risky project is:

$$\hat{\pi}_R = \begin{cases} \pi_R \ with\ probability\ L \\ y \quad with\ probability\ L\,(1-p) \\ 0 \quad with\ probability\ 1-L \end{cases} \tag{1}$$

and the payoff distribution for the safe project is:

$$\hat{\pi}_S = \begin{cases} \pi_S \ with\ probability\ L \\ 0\ with\ probability\ 1-L \end{cases} \tag{2}$$

However, the bank must always be in a position to meet the demand of its investors. If a fraction of investors ($\psi \in [0,1]$) decides to pre-maturely (i.e., at $t = 1$) withdraw their investments due to a shock, they receive the face value of their initial investment endowment back, which is 1 unit. Similar to Diamond and Dybvig (1983), the cumulative distribution function of ψ is $F(\psi)$ and the probability density function is $f\ (\psi)$. Given that we have an I number of investors, the total withdrawals at $t = 1$ can be up to ψI. To avoid triggering the liquidity shortfall threshold λ^*, the bank must have sufficient enough cash reserves (h) available to pay for the withdrawals. Otherwise, the bank must pay a penalty cost, n, due to triggering the liquidity shortfall. The condition of the liquidity shortfall plays an important role, because risky assets have a higher liquidity and a higher default risk. Therefore, early liquidation will penalize the bank with a very low, if any, return on the initial investment. This is described in Equation (3) below, which shows that if the total amount of withdrawals (ψI) exceeds the sum of the cash reserves and the amount invested in safe assets (i.e., $h + D_S$), the bank needs to liquidate all investments made in safe assets and the investments in risky assets to pay back their investors. On the other hand, when the maximum amount of total withdrawals (ψI) is more than the bank's cash reserves (h), but less than the sum of cash reserves and investments in safe assets $(h + D_S)$, the bank does not need to liquidate risky assets. As such, we have:

$$n = \begin{cases} \pi_S^R(\psi I - h) & if\ h < \psi I \leq h + D_S \\ \pi_S^R D_S + \pi_S^R(\psi I - h - D_S) & if\ \psi I > h + D_S \end{cases} \tag{3}$$

where D_S refers to a measure capturing the bank manager's incentive to invest in safe assets.

3.2 The search for yield and the agency problem

We suppose that everything else constant and without the intervention of the monetary authority, the bank's investment decisions are made based on the bank manager's incentives, similar to Acharya and Naqvi (2019), and Heider and Inderst (2012). The manager's income, c, depends on the return on investments so that: $c = c_S + c_R$, where c_S is the income received by investing in safe assets and c_R the income received by investing in risky assets that offer the potential for a higher return. The agency problem is in effect if the bank's authority conducts an audit and it is revealed that the bank manager has overinvested in risky assets to maximize the potential profits and that the liquidity shortfall threshold (λ^*) is, at the same time, high enough to be triggered. In this case, the manager is supposed to be reaching for yield because of the excessive risk undertaken with their investment decisions. In addition, a penalty cost (n) is imposed to the manager due to reaching for yield and the sharp increase in the probability to trigger the liquidity shortfall.

3.3 Monetary policy

A loosening monetary policy, such as the one where the Fed cuts the effective federal fund rate, decreases the price of liquid assets. The same effect on yields will hold for a loosening monetary policy based on the Fed's asset purchases to inject liquidity into the economy.

Proposition: *When the Fed conducts a monetary loosening policy, liquidity available to banks increases and there is an increase in the liquidity shortfall threshold, λ^*, above which an audit must be conducted. Based on that development, the bank has an incentive to invest in more risky assets to "search for yield". Therefore, with a loosening monetary policy, the liquidity threshold, l^*, above which a bank reaches for yield decreases.*

The first part of this Proposition builds on the traditional macroeconomic theory which suggests that an expansionary monetary policy alleviates financial frictions and increases liquidity in banks (Bernanke and Gertler, 1989). By extension, this policy increases the amount of funds available to the bank and accordingly decreases the probability that the bank will experience a liquidity shortfall event for any given λ^*. There is then a lower incentive to conduct an audit for the healthiness of the bank. Taking into account this effect, the second part of the Proposition suggests that the lower probability of an audit control raises the bank's incentive to reach for yield and shift their investments from safe to risky assets. Therefore, during an expansionary or loosening monetary policy, the expected probability and the subsequent cost for a liquidity shortfall are low and banks are more incentivized to reach for yield.

3.4 Transmission of the reach for yield effect and mitigation of the diabolic loop

The way the Fed's loosening policy affects and transmits shocks to other assets has been the subject of heated debate. We hypothesize and provide evidence that the shock transmission takes place through the portfolio balance channel because the Fed's purchases of US Treasury securities and its loosening policy influence the available supply of these securities to private investors. This, in turn, lowers the yields of Treasury assets, which make the latter less attractive, reduce the bond premia, and increase investors' risk appetite. As a result, bank managers reallocate their portfolio investments to more risky assets. We test this hypothesis in the European Monetary Union (EMU), with data of the four biggest European countries in terms of economic size (GDP): France, Germany, Italy, and Spain. These countries experienced the diabolic loop effect during the Eurozone crisis. Their governments intervened to rescue troubled banks from bankruptcy, which enormously increased their public debt and deteriorated their borrowing and credit costs. In turn, bank holdings of government debt caused new credit and borrowing problems to the banking sector in case of economic decline and recession. We provide empirical evidence that this vicious circle can be mitigated by the reach for yield effect, and the transmission of portfolio flows from the United States to European assets.

3.5 Econometric framework

We start with the transmission of monetary policy. Building on the theoretical model described in the previous sections, the central bank sets the short-term or current nominal interest rate i_t each period. It also controls the current and the expected future real interest rates by using appropriate conventional and unconventional tools, depending each time on the economic and financial condition. Accordingly, the central bank can influence, at least in a short-term time path, the market expectations, aggregate spending, saving and investment decisions. Based on the expectations hypothesis of the term structure, the best way to capture the impact of monetary policy actions is to examine the response of the government bond yield curve.[4]

In our empirical tests, we follow Gertler and Karadi (2015) to define the response of the daily, monthly, annual yield curve on an n period government bond to a surprise monetary policy action as "the surprise in the average of the annualized current short rate and the expected future short rates at $n-1$ periods into the future". The surprise effect in the government bond is captured by the excess return on the m period government bond, X_t^n, measured as the difference between the market rate i_t^{np} and the average of current and expected annualized short rates over the lifetime of the bond. We note at this point that the empirical evidence supporting this hypothesis and the overall identification procedure for the surprise effect of monetary policy actions was presented by Gertler and Karadi (2015). The surprise effect is described as follows:

$$X_t^n = i_t^{np} - E_t \frac{1}{n}\left\{\sum_{j=0}^{n-1} i_{t+j}\right\} \tag{4}$$

The policy rule for the interest rate is defined as:

$$i_t = g(\Phi_t) + \varepsilon_t \tag{5}$$

where i_t is the nominal interest rate; Φ_t represents the time t information set of the central bank's policy; $g(\Phi_t)$ is a function of the variables in the information set and denotes the unobserved systematic component of the policy; and ε_t is a collection of both unanticipated and anticipated shocks to the interest rate. More precisely, ε_t is defined as:

$$\varepsilon_t = v_t + y_{t-j} \tag{6}$$

[4] A detailed explanation on the relationship between monetary policy actions and the government bond yields is presented by Cochrane and Piazzesi (2005), and more recently by Gertler and Karadi (2015).

where v_t is the unanticipated shock at time t, and y_{t-j} denotes the anticipated shock received j periods in advance of period t, which is defined as a zero-coupon government bond yield in the expectations hypothesis.

In order to capture the impact of monetary policy on the short-term path of the interest rate, we follow the expectations hypothesis of the term structure and examine the response of an n period zero-coupon government bond yield curve. We re-write Equation (4) based on the new definitions as follows:

$$y_n^t = E_t \frac{1}{n} \left\{ \sum_{j=0}^{n-1} y_{t+j} \right\} + \pi_t^n \tag{7}$$

where y_n^t is the annual government bond yield and π_t^n is the annual bond term premium. As the theory suggests, π_t^n is a constant within a local region of the steady state. If the expectations hypothesis hold, any variation in the long-term rates reflects the variation of the current and the expected future short-term rates. Therefore, the transmission of monetary policy to credit costs works through the government bond yield curve. The real interest rate can then be defined as follows:

$$v_t + y_n^t - E_t p_t^n = E_t \frac{1}{n} \left\{ \sum_{j=0}^{n-1} (y_{t+j} - p_{t+j}) \right\} + \pi_t^n \tag{8}$$

where p_t is defined as the annualized percent change in the price level between time t and $t + j$, and $p_t^n = \frac{1}{n} \left\{ \sum_{j=0}^{n-1} y_{t+j} \right\}$.

To identify monetary surprises defined as v_t, we use external instruments in a vector autoregression (VAR) model. Our vector of economic and financial variables is denoted as $\boldsymbol{Y}_t$, with $\boldsymbol{A}$ and $\boldsymbol{C_j}$ $\forall\, j \geq 1$ conformable coefficient matrices, and e_t a vector of structural white noise shocks. Then, the VAR model takes the following form:

$$\boldsymbol{A}\boldsymbol{Y}_t = \sum_{j=0}^{n} \boldsymbol{C}_j \boldsymbol{Y}_{t-j} + e_t \tag{9}$$

Accordingly, we estimate the Equation (10) to generate the impulse responses to the monetary shock:

$$\boldsymbol{Y}_t = \sum_{j=0}^{n} \boldsymbol{B}_j \boldsymbol{Y}_{t-j} + \boldsymbol{s} e_t^n \tag{10}$$

Following the literature and more precisely Stock and Watson (2012), Mertens and Ravn (2013) and Gertler and Karadi (2015), let $\boldsymbol{Z}_t$ be a vector of instrumental variables and let e_t^w be a vector of structural shocks different from the monetary policy shock. The set of instruments, $\boldsymbol{Z}_t$, is correlated with the policy shock e_t^n and is orthogonal to e_t^w, as below:

$$\begin{cases} E\left[\boldsymbol{Z}_t e_t^{w'}\right] = 0 \\ E\left[\boldsymbol{Z}_t e_t^{n'}\right] = \Phi \end{cases} \tag{11}$$

The procedure for the estimation of the vectors is similar to Mertens and Ravn (2013) and Gertler and Karadi (2015).

3.6 Measuring surprises from monetary policy actions

In this section, we analyze the instruments and the model we use. It is important to note that a policy indicator variable is different from the variable used as an instrument to capture a monetary policy shock upon the appropriate monetary policy stance determined by the FOMC. Specifically, in our model, the policy indicator is represented by a change in the n-year government bond rate or in the federal funds rate, before and after the FOMC meeting date, where n can be the one-year or the two-year U.S. government bond rate. We consider two different instrument combinations: the surprise in the federal funds futures rate (FF1) and the surprise in the three months ahead futures rate (FF4). The instruments are used along with the residuals to identify the contemporaneous impact of monetary policy surprises. In short, the policy indicator is represented by the government bond rate, while the surprise effect is quantified by the federal funds futures rate (FF1 and FF4). Our independent variables are the three, five, and tenyear government bond rates. The Equation (12) estimates the impact of policy changes on asset returns:

$$\Delta R_t = \alpha + \beta (i_t^n)^u + \varepsilon_t \tag{12}$$

where ΔR_t is the change in an asset return on an FOMC day and i_t^n is the interest rate on an n-month U.S. government bond which represents the policy indicator. $(i_t^n)^u$ is the same day un-anticipated movement in i_t^n. Following our identification technique, the instrumental variables estimation (i.e. FF1 and FF4) isolates the variation in i_t^n due to pure monetary policy surprises, which is orthogonal to the error term ε_t and, in turn, leads to the estimates of β. We also use our VAR model for our external instrument identifications and, for a robustness check, we compare it with a Cholesky identification.

More precisely, we use a set of external instruments to identify monetary policy shocks surprises in the federal funds rate on FOMC dates. In line with the literature, we let f_{t+j} to be the settlement price on the FOMC day in month t for interest rate futures, which can be the federal fund rate, expiring in $t+j$. We also let $f_{t+j,-1}$ to be the corresponding settlement price for the day *before* the FOMC meeting. Moreover, the unexpected movement in the target funds rate for the month $t+j$ is $(E_t i_{t+j})^u$, with $(E_t i_t)^u = i_t^u$ representing the surprise in the current short rate. Similarly, $(E_t i_{t+j})^u$ can be defined as the surprise in the futures rate as:

$$(E_t i_{t+j})^u = f_{t+j} - f_{t+j,-1} \tag{13}$$

when $j = 0$, the surprise in futures rates measures the shock to the current federal funds rate, similar to Gertler and Karadi (2015) and Kuttner (2001). When $j \geq 1$, the surprise in the expected target rate measures a shock to the future rate, like the forward guidance measure used by Gürkaynak, Sack, and Swanson (2005).

To identify monetary policy shocks, our baseline analysis uses the one-year government bond rate as the monetary policy indicator in the VAR framework, similar to Gertler and Karadi (2015). A component of the VAR residuals for the one-year government bond rate then represents a monetary policy shock with exogenous surprises in the federal funds rate. We also use the two-year government bond rate as a sensitivity check to show the robustness of the results.

The policy surprise in the government bond can be captured by using Equation (13). More precisely, we estimate the return of the one-year government bond rate, i_t^{12}, as a function of current and expected short rates along with a term premium which is φ_t^{12}. As mentioned above, the surprises in the current month's federal funds futures (FF1) and in the three-month federal funds futures (FF4) with respect to FOMC dates are used as policy surprise instruments.

$$i_t^{12} = E_t \frac{1}{12}\left\{\sum_{j=0}^{11} i_{t+j}\right\} + \varphi_t^{12} \tag{14}$$

Once the residuals from Equation (7) are estimated, they can be employed along the instrumental variables to identify the contemporaneous impact of monetary policy surprises by using Equation (10). Similar to Gertler and Karadi (2015), we use a variant of our framework to examine various market interest rates and monetary policy surprises in order to evaluate our choice of a policy indicator along with the instruments for policy shocks. For our instruments, we use interest rate futures surprises on FOMC dates. We use a monthly VAR model to evaluate the indicator and instrument choice. Concretely, the model includes our instruments, that is measured as monthly average rates surprises instead of the futures surprises of FOMC days the log of the Gross Domestic Product (GDP), the log of the Consumer Price Index (CPI), the one-year government bond rate (representing the policy indicator), and the credit default swap spread. In addition, a robustness check is carried out by using the excess bond premium as introduced by Gilchrist and Zakrajšek (2012). The reduced form VAR residual for i_t^{12} is equivalent to one the month ahead forecast error:

$$i_t^{12} - E_{t-1} i_t^{12} = \frac{1}{12} \sum_{j=0}^{11} \{E_t i_{t+j} - E_{t-1} i_{t+j}\} + \varphi_t^{12} - E_{t-1} \varphi_t^{12} \quad (15)$$

Equation (15) shows that a monetary policy shock is a linear combination of exogenous shocks to the current and expected future path of future rates.

4. Empirical results

4.1 Data

We use daily and monthly data frequency from Bloomberg, and Thomson Reuters Datastream,for economic and financial variables over the period from January 2008 to December 2017. In order to test for the search for yield effect, we have also collected mutual funds data (inflows/outflows) from Refinitiv, related to the U.S. and Eurozone High Yield Corporate Bonds, Low Yield Corporate Bonds, Low Capitalization Equities, and High Income Equities Funds.

-Please Insert Table 1 about here-

-Please Insert Figures 1 and 2 about here-

We choose the starting point to coincide with the eruption of the Global Financial Crisis (GFC) which later metastasized to the eurozone crisis. We consider two policy instruments to capture the effects of monetary policy surprises within a one-day window of the FOMC announcement: the surprise in the current month’s federal funds futures rate (FF1) and the surprise in the three-month federal funds futures rate (FF4). Similar to Gertler and Karadi (2015), our policy indicators include the one-year and the two-year U.S. government bond rates as well as the credit default swaps. Their responses are measured in a daily window in line with the literature. The dates for the FOMC meetings are presented in Table 1. Figures 1 and 2 show the daily government bond yield and credit default swap price movements with different maturities for the whole sample period.

4.2 Effects of a monetary policy shock on U.S. (domestic) assets

Table 2 presents the results related to the effects of a monetary policy shock (effect of surprise) on the US government bond rates. The coefficient in each column shows the response of the relevant asset return to a 100 basis points decrease in the federal funds rate due to an exogenous monetary policy shock, while each row has a combination of a policy indicator and an external instrument (in line with equation 15) capturing the policy shock. Note that in the aftermath of the GFC, the Federal Reserve followed a loosening policy to reduce the cost of borrowing (i.e., government bond rates) and the cost of credit (i.e., sovereign risk via credit default swaps). Thus, a positive response of coefficients in Table 2 implies a decrease in bond rates of return, while a negative response implies an increase in bond rates. We first find that policy surprises over the study period have generally led to yield reductions. Furthermore, the surprises contained in the one and two-year government bond rates have a significant and stronger effect on government bond yields than the surprises induced by federal funds rate which is instrumented by the one-month Fed funds futures rate (FF1). The 5-year and 10-year government bond yields even do not react to the policy surprises in the Fed funds rate since the associated coefficients are insignificant.

-Please Insert Table 2 about here-

The results also show evidence of a stronger effect from the policy surprises on government bond yields when the 3-month Fed funds futures rate (FF4) is used as external instrument for both the one-year and the two-year government bond rates. The most important effect is observed in the case of the 2-year, 3-year and 5-year government bonds. These results are in line with the existing literature in that a significant part of the variation of the Fed funds rate reflects changes in the timing of the rate adjustment (Kuttner, 2001) and that the 3-month Fed funds futures rate captures, as an instrument, more efficiently policy surprises (Gertler and Karadi, 2015).

4.3 Effects of a monetary policy shock on U.S. mutual funds inflows and outflows

We use similar tests with our instrumental variables in order to investigate whether a search for yield effect takes place. Table 3 reports the results of a monetary policy shock on the inflows/outflows of U.S. mutual funds investing in four different categories of assets: High Yield Corporate Bonds, Low Yield Corporate Bonds, Low Capitalization Equities, and High-Income Equities. The results typically reveal that an accommodative monetary policy shock, which incentivizes a lower policy interest rate, causes significant net inflows to riskier mutual funds, such as the High Yield Corporate Bonds and the Low Capitalization Equities. On the contrary, the shock causes significant outflows for mutual funds that invest in safer assets, such as the Low Yield Corporate Bonds. Similar to the results reported in Table 2, the one- and two-year bond rates as policy indicators have a much stronger impact on the mutual funds flows than does the federal funds rate. In particular, when the 3-month futures rate (FF4) is used as external instrument, the results are stronger for all mutual funds in our sample.

-Please Insert Table 3 about here-

Next, we employ the policy indicators and the external instruments mix in the monthly VARs. To achieve this, we turn the future surprises on FOMC days into monthly average surprises. Table 4 shows the results, where Panels A and B report respectively the responses of US government bond rates and US sovereign credit default swaps (as policy indicators) to residuals of the policy instruments used. The evidence indicates the effectiveness of the Fed funds futures rates in capturing monetary shocks and explaining the changes in government bond yields, especially when the one- and the two-year government bonds are used as policy indicators together with the 3-month Fed funds futures rate (FF4) as a policy instrument. Following the suggestion of Stock, Wright and Yogo (2002), the threshold value of the *F*-statistic from the first stage regression should be above 10, in order to avoid a weak instrument problem. When the FF4 instrument is used, three of the five cases have a F-statistic above this threshold. This instrument has significant effects on government bond rates of all maturities and explains, in the best case, 3.7 percent of monthly innovation in the one-year government bond rate. Differently, a close look at Panel B suggests that the 1-month Fed funds futures rate is a more effective policy instrument than the 3-month Fed funds futures rate for explaining the changes in the credit cost.

-Please Insert Table 4 about here-

It is clear from the results in Tables 2, 3, and 4 that the two-year government bond rate is the best policy indicator and the 3-month Fed funds futures rate (FF4) is the best external instrument for the policy indicator. Building on these findings, they are used as the most suitable policy indicator and surprise factor for our further analysis of the reach-for-yield hypothesis and the sovereign-bank diabolic loop within the monetary VAR, similar to one developed by Gertler and Karadi (2015). Accordingly, our setting is unlikely to have a weak instruments problem.

4.3 Analysis of the impulse responses in the VAR model

We now turn to the empirical estimation of our monetary VAR model which includes the 3-month Fed funds futures rate (FF4) as an external instrument, the two-year government bond rate as a policy indicator, the one-year credit default swap representing the credit conditions and the excess bond premium as in Gilchrist and Zakrajšek (2012) (henceforth referred to as GZ bond premium). The latter variable has been widely used in the literature as a good proxy for credit conditions in the private sector since it seizes the spread between bond yields in the private versus the public sector. It is calculated as the spread between an index of rates of return on corporate securities and a government bond rate of similar maturity. By taking into account the excess bond premium in our sample, we can estimate the effect of the exogenous monetary policy surprises on the credit costs of both the public and the private sector through our instrumental variables.

-Please Insert Figure 3 about here-

Figure 3 presents the impulse responses of the financial variables in the above-mentioned monetary VAR, along with the 95 percent confidence bands which are computed using bootstrapping methods similar to Mertens and Ravn (2013). The graphs on the left panel show the responses of variables under consideration to monetary policy surprises identified by using the 3-month Fed funds futures rate (FF4), while those on the right panel present the responses when a Cholesky identification process. We also report the *F*-statistic (18.1) and the robust *F*-statistic (13.6) to confirm the validity of the FF4 instrument as well as the necessity for controlling the heteroscedasticity. Regarding the impulse responses, we find that a one-standard-deviation surprise in the Fed funds rate caused a positive response of 10 basis points in the two-year government bond rate. There is also a positive response of 10 basis points in the GZ bond premium and a positive response of roughly 10 basis points in the sovereign risk which is captured by the sovereign credit default swap. Taken together, the results suggest that a loosening monetary policy leads to a decrease in government bond rate and the cost of public and private debt. By contrast, when the Cholesky identification is used to identify monetary policy shocks (i.e., , right-panel graphs), we find evidence of elevated volatility of impulse response functions, which typically questions the validity of the results. The monetary policy shock induces an insignificant response in each variable, and in some cases a decline is observed shortly after the shock. These findings suggest that our external instrument approach is better suited for the identification of monetary policy surprises in financial assets.

4.4 Reaching for yield effect in the European markets through the portfolio balance channel

In the previous sections, we showed the effect of a monetary policy surprise on U.S. financial assets. Specifically, we found a positive relationship between a monetary policy shock and the change in the two-year government bond rate, the excess bond premium, and the one-year sovereign credit default swap. The results imply that a loosening monetary policy, which drives the Fed funds rate down, will easy the credit conditions (i.e. credit default swap) and decrease the borrowing cost of the public sector (i.e., the government bond rate) and the credit cost of the private sector (i.e., bond premium). As explained in our theoretical framework, an accommodative monetary policy creates an incentive to "search for yield". Since the global financial crisis of 2008, the U.S. Fed has expanded its balance sheet in unprecedented levels as shown in Figure 4. The main programs used by the Fed were a number of asset purchases which led to a significant decrease in the yield of many U.S. assets.

-Please Insert Figure 4 about here-

To the extent that the U.S. financial assets offer a lower return, banks search for yield in alternative markets or countries. For instance, Fratzscher, Lo Duca and Straub (2018) show that the introduction of Quantitative Easing in the United States caused a rebalancing of investments towards emerging markets that offer a more attractive return. The transmission of investments is realized through the so-called "portfolio rebalancing channel". Table 3 shows the first part of this theory which states that a lower yield in assets is associated with fund outflows. The second part of this theory is confirmed via Table 5, whereby Panel A in Table 5 shows the search for yield effect on the European funds around the dates that the Fed announced accommodative programs of monetary policy (see also Table 1). The monetary policy shock in the

United States induces a modest but statistically significant increase in the inflow of each European mutual fund. The increase in inflows is found for the European equities across all four major countries we consider (France, Germany, Italy, and Spain). In the meanwhile, we note that Table 3 shows an increase in the outflows for similar U.S. assets. Panel B in Table 5 reveals that U.S. monetary policy shocks are associated with a significant decrease in the one- and two-year government bond rates across all four major European countries. The same effect is found in Panel C for the credit costs of the European countries, where the 1-year sovereign credit default swaps experienced a significant drop for France, Germany, Italy and Spain.

-Please Insert Table 5 about here-

Table 6 reports results for the reaching for yield effect on European assets by using the whole sample period. Firstly, we find that the accommodative monetary policy followed by the U.S. Fed was associated with inflows to European denominated mutual funds. Secondly, the results reveal that U.S. monetary policy shocks have a significant and strong effect on the borrowing costs of the four major European countries. For example, the results from the monetary VAR indicate that the reaching for yield effect is associated with a decrease of 0.3 percent in the German one-year government bond rate and a decline of 0.53 percent in the two-year government bond rate. Similar results are found across the government bonds of all sample countries. Accordingly, the credit costs drop and more specifically, credit default swap rates of both the one-year and the two-year maturities decrease for all sample countries. To sum up, the results indicate that monetary policy shocks putting into work the portfolio balance channel reduce the cost of borrowing and the sovereign risk for the sample European countries. Therefore, the diabolic loop effect experienced in the European countries during the Eurozone debt crisis could be mitigated by the reach for yield effect where the transmission of portfolio flows from U.S. assets to European assets.

-Please Insert Table 6 about here-

In Figures 5 and 6, we present the impulse responses from the search for yield effect on the borrowing costs and credit conditions for our sample European countries. We employ the monetary VAR with the 3-month Fed futures rate (FF4) as an external instrument to identify policy surprises, along with the 95 percent confidence bands computed using a bootstrapping method. The estimation results reported in Tables 5 and 6 show that the stronger effect is found for the rates of the two-year government bonds and the one-year credit default swaps. Hence, we use the two-year bond rates as the most valid policy instrument to capture the reaching for yield effect. Figure 5 shows the response of the borrowing cost (i.e., the two-year government bond rate) to monetary policy surprises. We see that the reach for yield effect initially decreases the cost of borrowing for all four European governments in the short-term, whilst the effect dies a few quarters later. The shifts in the Italian and Spanish yield curves are much more pronounced than that of the Germany yield curve. This effect might be related to the diabolic loop which was more obvious in Italy and Spain. Particularly, Italy and Spain intervened to bailout many banks and Italy experienced a huge debt to GDP ratio because of these interventions. On the contrary, the German government managed to keep the debt to GDP ratio below 100 percent and at the same time intervened to rescue a limited number of domestic banks.

-Please Insert Figures 5 and 6 about here-

The impulse responses in Figure 6 show that the credit cost initially declines in the short-term, and similar to the response of the government bonds, the effect disappears a few quarters later. The stronger response is observed for Italy and Spain, presumably because of the magnitude of the sovereign debt problems, which in turn affected the credit channel and the financial intermediation in these countries.

Overall, the above-mentioned results suggest that the reach for yield effect reduced both the borrowing costs and the sovereign risk for all four European countries under consideration.

4.5 Robustness check

We carry out a robustness check by replacing the two-year government bond rate policy indicator with the technique of Gürkaynak, Sack and Swanson (2005) so that all the relevant bond rates react with futures rate surprises.

-Please Insert Table 7 about here-

Table 7 presents the responses of the main variables. We use the 1-month Fed funds rate (FF1), and the 2-month Fed funds rate (FF2) as instruments. The obtained estimation results are found to be in line with our main findings as the two-year government bond rates and the credit default swap rates are significantly affected by the search for yield effect within this new empirical setting. Yet, the rest of the results are weak, statistically insignificant and potentially with instrument problems.

5. Conclusion

In this paper, we build on the theoretical framework of Stein (2002), and Acharya and Naqvi (2019) to introduce a macro-financial model of a monetary authority that follows a loosening monetary policy. According to Acharya, Drechsler, and Schnabl (2014) and Gennaioli, Martin, and Rossi (2014) a diabolic loop effect took place in Europe during the sovereign risk crisis. European governments intervened to rescue troubled banks from bankruptcy, and this resulted into a deterioration of their public debt, and, by extension, of their borrowing and credit costs. In turn, bank holdings of government debt caused new credit and borrowing problems to the banking sector. Our paper extends these works by providing evidence of a solution to the puzzle. More precisely, the findings suggest that this vicious circle can be mitigated by the reach for yield effect and the transmission of portfolio investments flows from U.S. to European assets.

Particularly, the accommodative monetary policy followed by the Fed reduces the yields of domestic assets, increases liquidity and the subsequent threshold above which a liquidity shock can damage the banks. This in turn, incentivizes bank managers to invest in risky assets. We employ a monetary VAR model to provide novel empirical evidence that the reach for yield effect transmits through the portfolio balance channel. Specifically, when the U.S. Fed follows an accommodative monetary policy, we find that U.S. assets offer lower yields, and this is associated with an increase in fund outflows. This effect is attributed to the search for yield incentive which works through the portfolio rebalancing channel. We also find that this effect is associated with a significant improvement in government borrowing costs and credit conditions not only for domestic U.S. assets, but also for assets in foreign countries. Therefore, the reach for yield effect attenuates the effects of financial fragility in the domestic banking sector, improves government funding costs and mitigates the diabolic loop effect in the Monetary Union, during the Eurozone debt crisis.

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Figure 1. Borrowing cost: The movement of the U.S. Government bond yields

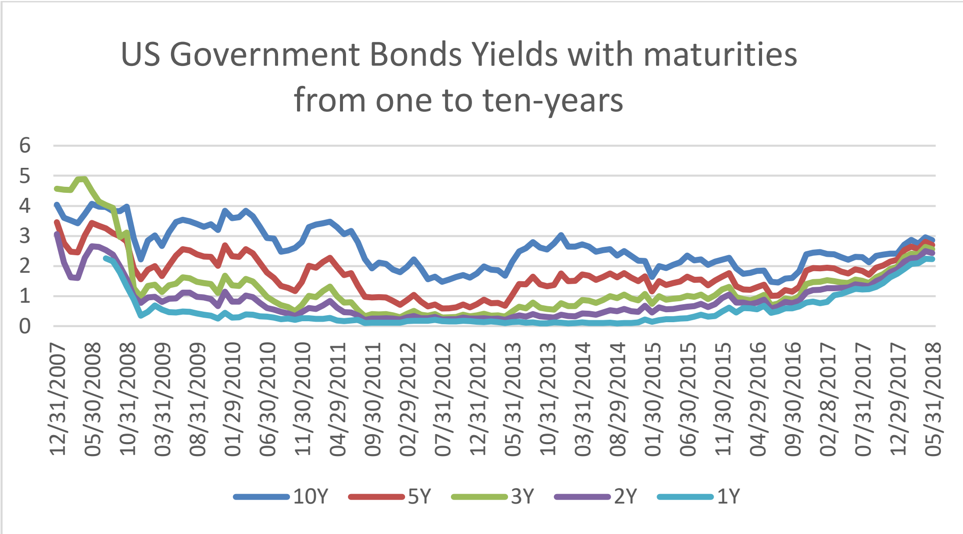


Figure 2. Credit costs, and sovereign risk: The movement of the U.S. credit default swaps

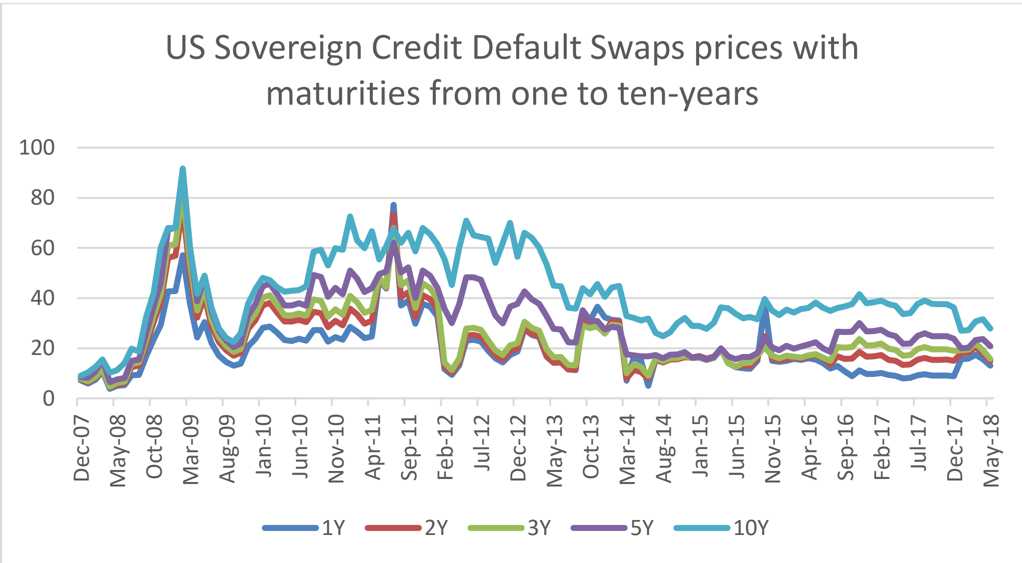
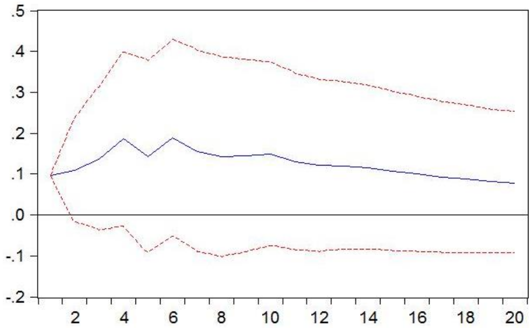
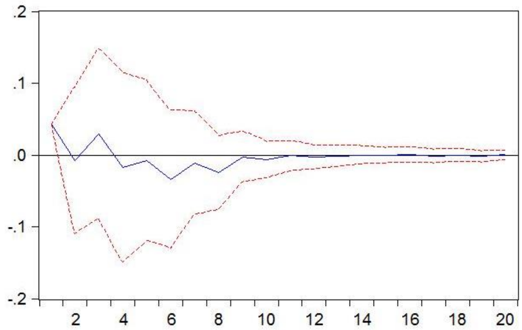


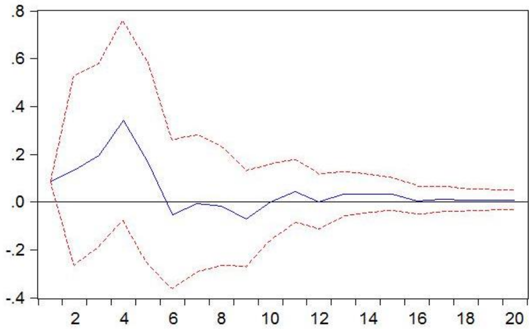
Figure 3. Impulse responses of U.S. financial assets to monetary policy surprises.



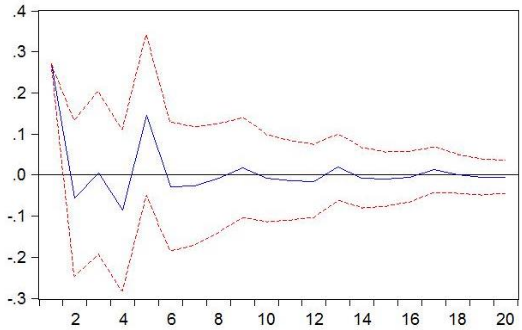
Responses of two-year government bond, identified with external instruments



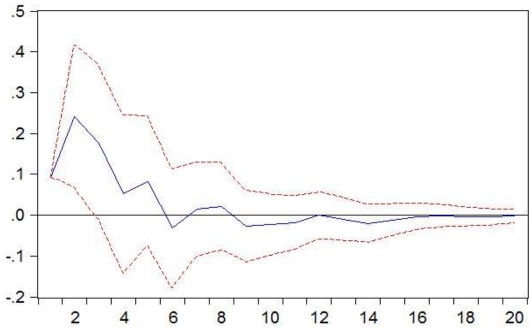
Responses of two-year government bond, identified with a Cholesky process



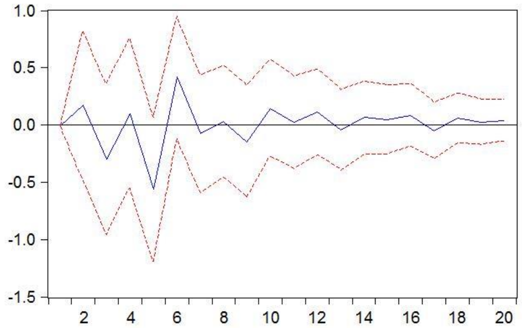
Responses of GZ excess bond premium, identified with external instruments



Responses of GZ excess bond premium, identified with a Cholesky process



Responses of one-year credit default swap, identified with external instruments



Responses of one-year credit default swap, identified with a Cholesky process

Notes: The left axis shows percentage and the right axis shows the time period in quarters. First stage regression: *F*-statistic: 18.10; Robust *F*-statistic: 13.67; R^2: 0.054; Adjusted R^2: 0.042.

Figure 4. Total assets of Federal Reserve balance sheet (in $ millions)

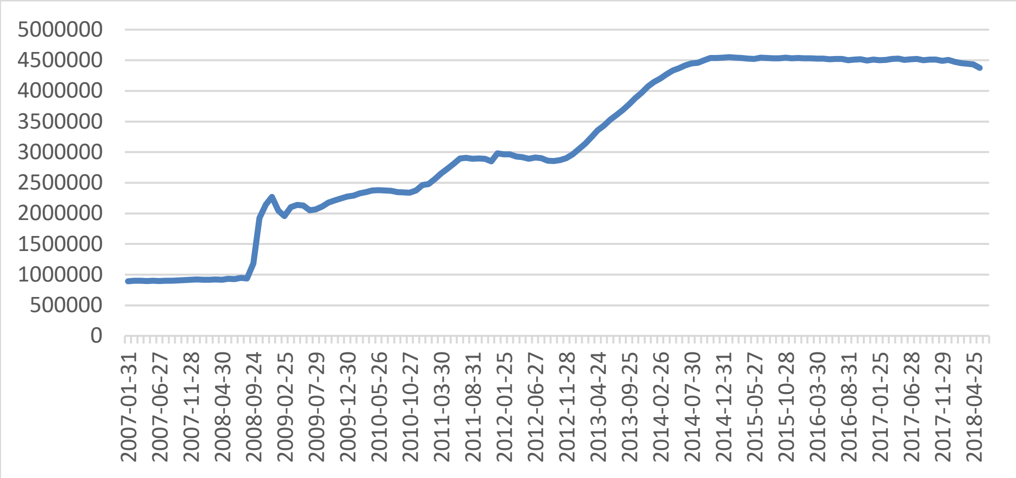
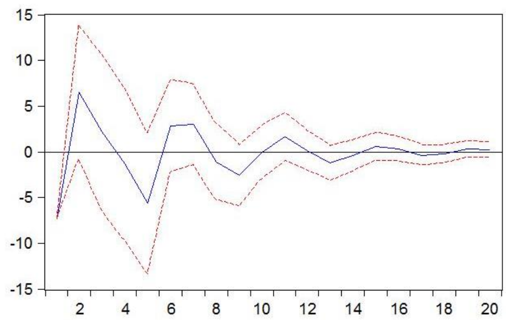
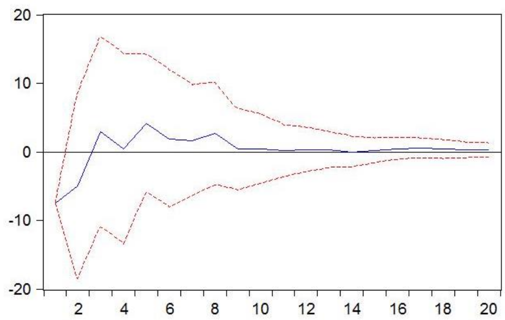


Figure 5. The search for yield effect on the European government bond rates.

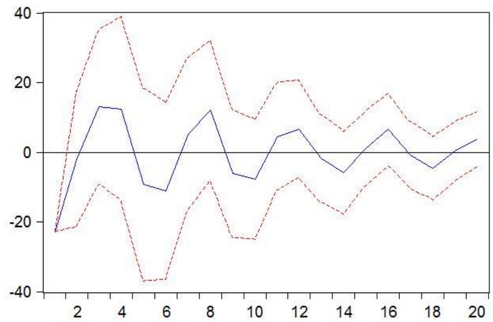
German 2-year government bond rate



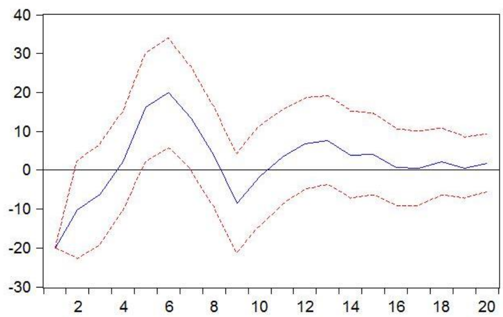
French 2-year government bond rate



Italian 2-year government bond rate



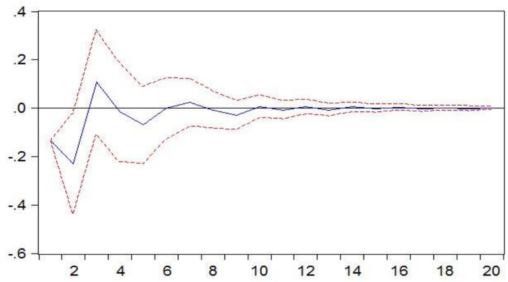
Spanish 2-year government bond rate



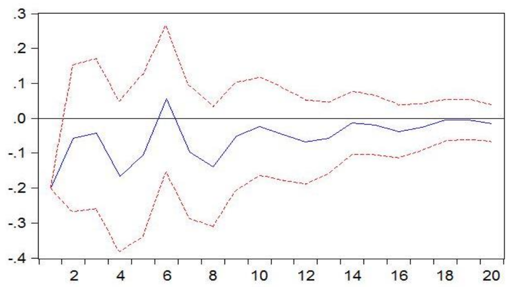
Notes: The left axis shows percentage and the right axis shows time in quarters.

Figure 6. The search for yield effect on the European one-year sovereign CDS rates.

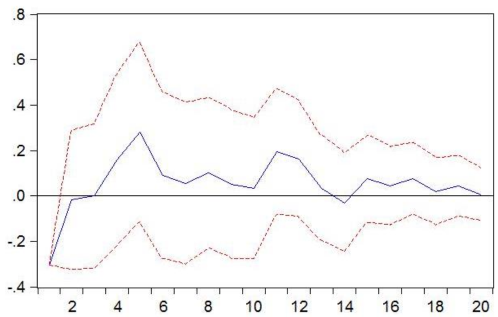
Germany credit cost price response



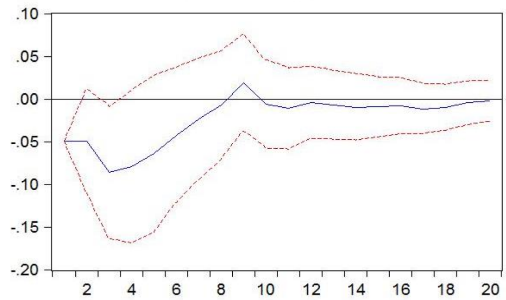
France credit cost price response



Italy credit cost price response



Spain credit cost price response



Notes: The left axis shows percentage and the right axis shows time in quarters.

Table 1. Federal Open Market Committee (FOMC) post-meeting key announcements on expanding their balance sheet and committing to lower interest rates for the long term.

	Date	Program / Key Announcement	Event	Description
1	25/11/2008	QE1	FOMC statement	LSAPs announced: Fed will purchase $100 billion
2	16/12/2008	QE1	FOMC statement	Suggestion of extending QE to treasuries
3	18/3/2009	QE1	FOMC statement	LSAPs expanded: Fed will purchase $300 billion in Treasuries, plus $850 billion in other securities
4	3/11/2010	QE2	FOMC statement	QE2 announced: Fed will purchase $600 billion in Treasuries
5	21/9/2011	MEP	FOMC statement	Maturity Extension Program announced: Fed will purchase $400 billion in Treasuries with maturities of 6-30 years
6	20/6/2012	MEP	FOMC statement	Maturity Extension Program extended
7	13/9/2012	QE3	FOMC statement	QE3 announced: Fed will purchase $40 billion of MBS per month until further notice
8	12/12/2012	QE3	FOMC statement	QE3 expanded: Fed will continue to purchase $45 billion of long-term Treasuries per month
9	18/12/2013	QE3	FOMC statement	QE3 extended: Fed will continue to purchase $40 billion of long-term Treasuries and $35 billion of MBS per month
10	19/03/2014	Dual Mandate	FOMC statement	The committee currently anticipates that, even after employment and inflation are near mandate-consistent levels, economic conditions may, for some time, warrant keeping the target federal funds rate below levels the Committee views as normal in the longer run.
11	16/12/2015	Low Interest rates Commitment	FOMC statement	The Committee expects that economic conditions will evolve in a manner that will warrant only gradual increases in the federal funds rate; the federal funds rate is likely to remain, for some time, below levels that are expected to prevail in the longer run.
12	21/09/2016	Accommodating policy commitment	FOMC statement	The Committee judges that the case for an increase in the federal funds rate has strengthened but decided, for the time being, to wait for further evidence of continued progress toward its objectives. The stance of monetary policy remains accommodative, thereby supporting further improvement in labor market conditions and a return to 2 percent inflation.

Table 2. Responses of US government bond yields to monetary policy shocks.

Indicator and instruments	Government bond yields			
	US1YBOND	US2YBOND	US3YBOND	US5YBOND
FF, FF1	0.191*	0.084*	0.052	0.043
	(0.466)	(0.483)	(0.301)	(0.266)
1YR, FF1	0.323*	0.199*	0.114*	0.071*
	(0.229)	(0.344)	(0.201)	(0.036)
1YR, FF4	0.364**	0.317**	0.285*	0.140*
	(0.312)	(1.183)	(0.839)	(0.629)
2YR, FF1		0.617***	0.448**	0.221**
		(1.114)	(0.829)	(0.121)
2YR, FF4		0.669***	0.452**	0.054**
		(2.856)	(1.005)	(0.220)

Note: Robust z-statistics are shown in parentheses. ***, **, and * denote significance at the 1%, 5% and 10% levels, respectively.

Table 3. Effects of monetary policy shocks on US mutual funds inflows/outflows.

Indicator and instruments	High Yield Corporate Bonds	Low Yield Corporate Bonds	Low Capitalization Equities	High Income Equities
FF, FF1	0.078*	-0.003	0.044*	-0.009
	(0.451)	(0.662)	(0.472)	(0.704)
1YR, FF1	0.086*	-0.052	0.061*	-0.018
	(0.372)	(0.584)	(0.213)	(0.621)
1YR, FF4	0.112**	-0.073**	0.107*	-0.042*
	(0.340)	(0.326)	(0.233)	(0.677)
2YR, FF1	0.137**	-0.081**	0.118**	-0.048**
	(0.304)	(0.344)	(0.399)	(0.421)
2YR, FF4	0.152**	-0.090**	0.125**	-0.051**
	(0.225)	(0.318)	(0.405)	(0.330)

Note: Robust z-statistics are shown in parentheses. *** denotes significance at the 1 percent level, ** denotes significance at the 5 percent level, * denotes significance at the 10 percent level.

Table 4. Effects of external instruments on the first stage residuals of the two-variable VAR on U.S. government bonds and Credit Default Swaps

Panel A. Results for the U.S. government bonds (*Monthly*, 2008-2017).

Variables	US1YBOND	US2YBOND	US3YBOND	US5YBOND	US10YBOND
FF1	0.843**	0.347**	0.055	0.046	0.003
	(3.185)	(1.164)	(0.116)	(0.161)	(0.079)
Observations	122	122	122	122	122
R^2	0.034	0.031	0.009	0.008	0.000
F-statistic	15.65	11.22	7.64	3.10	1.04
FF4	0.487**	0.360***	0.319**	0.316***	0.175***
	(1.193)	(1.161)	(1.116)	(0.156)	(0.077)
Observations	122	122	122	122	122
R^2	0.037	0.032	0.026	0.024	0.019
F-statistic	14.93	12.17	11.08	9.25	7.34

Panel B. Results for the U.S. Sovereign Credit Default Swap prices (*Monthly*, 2008-2017).

Variables	US1YCDS	US2YCDS	US3YCDS	US5YCDS	US10YCDS
FF1	0.225**	0.149*	0.123*	0.065	0.118
	(1.316)	(1.240)	(1.211)	(0.156)	(0.125)
Observations	122	122	122	122	122
R^2	0.027	0.022	0.021	0.012	0.009
F-statistic	10.24	9.16	8.83	5.97	3.56
FF4	0.183*	0.111	0.131	0.151	0.079
	(1.108)	(0.231)	(0.203)	(0.151)	(0.120)
Observations	122	122	122	122	122
R^2	0.021	0.016	0.024	0.007	0.005
F-statistic	9.88	7.01	4.61	1.25	0.80

Note: Robust *t*-statistics are shown in parentheses; *** denotes significance at the 1 percent level, ** denotes significance at the 5 percent level, * denotes significance at the 10 percent level.

Table 5. Reaching for yield effects in the European markets around the Fed policy announcement dates

Panel A: Mutual Funds Inflows / Outflows (in percentage change)

Euro Area Mutual Funds	High Yield Corporate Bonds	Low Yield Corporate Bonds	Low Cap/za-tion Equities	High Income Equities
Germany	6.482***	8.021**	9.458**	10.194**
	(0.406)	(0.277)	(0.403)	(0.310)
France	7.039***	8.773**	9.742**	10.300**
	(0.421)	(0.281)	(0.338)	(0.295)
Italy	5.059**	8.117**	6.235**	9.122**
	(0.488)	(0.382)	(0.311)	(0.446)
Spain	7.803***	9.450**	10.107**	10.835**
	(0.318)	(0.239)	(0.355)	(0.302)

Panel B: Government Bonds (in percentage change)

Countries	1 Year Government bond	2 Years Government bond	3 Years Government bond	5 Years Government bond	10 Years Government bond
Germany	-0.496***	-0.244**	-0.122*	-0.084*	0.003
	(0.461)	(0.119)	(0.065)	(0.078)	(0.074)
France	-0.360**	-0.254**	-0.163**	-0.101	-0.020
	(0.162)	(0.123)	(0.064)	(0.079)	(0.079)
Italy	-0.227**	-0.308**	-0.202**	-0.093*	0.010
	(0.201)	(0.136)	(0.072)	(0.087)	(0.090)
Spain	-0.544**	-0.345**	-0.139**	-0.035	-0.012
	(0.825)	(0.350)	(0.176)	(0.172)	(0.123)

Panel C: Credit Default Swaps (in percentage change)

Countries	1Y CDS	2Y CDS	3Y CDS	5Y CDS	10Y CDS
Germany	-0.018**	-0.014*	-0.007	-0.055	-0.141
	(0.084)	(0.098)	(0.106)	(0.131)	(0.124)
France	-0.099**	-0.108*	-0.061	-0.098	-0.179
	(0.135)	(0.149)	(0.164)	(0.194)	(0.177)
Italy	-0.064**	-0.123*	-0.122	0.097	0.235*
	(0.082)	(0.097)	(0.107)	(0.131)	(0.130)
Spain	-0.062**	-0.293*	-0.519*	0.118	0.144
	(0.390)	(0.457)	(0.472)	(0.505)	(0.419)

Note: This table shows the reaching for yield effect on the first stage residuals of the VAR model on European mutual fund investments, government bonds and credit default swaps with monetary policy shocks identified around the dates the Fed announced a significant expansion of their balance sheet (*Monthly*, 2008-2017). Standard errors are shown in parentheses; *** denotes significance at the 1 percent level, ** denotes significance at the 5 percent level, * denotes significance at the 10 percent level.

Table 6. Reaching for yield effects in the European markets with monetary policy shocks through the whole sample

Panel A: Mutual Funds Inflows / Outflows (in percentage change)

Euro Area Mutual Funds	High Yield Corporate Bonds	Low Yield Corporate Bonds	Low Cap/zation Equities	High Income Equities
Germany	6.821***	8.376**	9.750**	10.270**
	(0.416)	(0.245)	(0.399)	(0.302)
France	7.218***	8.880**	9.893**	10.441**
	(0.403)	(0.272)	(0.331)	(0.287)
Italy	5.372**	8.236**	6.471**	9.341**
	(0.428)	(0.345)	(0.310)	(0.438)
Spain	7.991***	9.578**	10.455**	10.970**
	(0.308)	(0.231)	(0.342)	(0.300)

Panel B: Government Bonds (in percentage change)

Countries	1 Year Government bond	2 Years Government bond	3 Years Government bond	5 Years Government bond	10 Years Government bond
Germany	-0.312**	-0.536**	-0.703***	-0.733***	-0.754***
	(0.280)	(0.262)	(0.255)	(0.277)	(0.289)
France	-0.429**	-0.333***	-0.616***	-0.673**	-0.643**
	(0.271)	(0.272)	(0.251)	(0.286)	(0.317)
Italy	-0.701***	-0.742***	-0.940***	-0.803**	-0.797**
	(0.340)	(0.301)	(0.287)	(0.317)	(0.367)
Spain	-0.502***	-0.509***	-0.353**	-0.487**	-0.793**
	(4.352)	(0.765)	(0.688)	(0.614)	(0.485)

Panel C: Credit Default Swaps (in percentage change)

Countries	1Y CDS	2Y CDS	3Y CDS	5Y CDS	10Y CDS
Germany	-0.122**	-0.121**	-0.129**	-0.123*	-0.101
	(0.110)	(0.119)	(0.121)	(0.138)	(0.138)
France	-0.058*	-0.123**	-0.165**	-0.186*	-0.138
	(0.180)	(0.184)	(0.193)	(0.210)	(0.201)
Italy	-0.522***	-0.552***	-0.567***	-0.475***	-0.560***
	(0.110)	(0.120)	(0.126)	(0.142)	(0.149)
Spain	-0.480***	-0.580***	-0.619***	-0.348**	-0.305*
	(0.511)	(0.553)	(0.541)	(0.534)	(0.465)

Note: This table shows the reaching for yield effect on the first stage residuals of the VAR model on European mutual fund investments, government bonds and credit default swaps with monetary policy shocks through the whole sample period (*Monthly*, 2008-2017). Standard errors are shown in parentheses; *** denotes significance at the 1 percent level, ** denotes significance at the 5 percent level, * denotes significance at the 10 percent level.

Table 7. Effects of monetary policy shocks on bond rates and credit default swaps based on the technique of Gürkaynak, Sack and Swanson (2005).

	GER1YBOND	GER2YBOND	GER3YBOND	GER5YBOND	GER10YBOND
FF1	-0.041	-0.150**	-0.112*	-0.574	-0.829
	(0.179)	(0.080)	(0.099)	(0.496)	(2.728)
FF2	-0.046	-0.191**	-0.051	-1.133**	-3.976*
	(0.180)	(0.080)	(0.098)	(0.496)	(2.703)
	GER1YCDS	GER2YCDS	GER3YCDS	GER5YCDS	GER10YCDS
FF1	-0.010	-0.033*	-0.008	-0.004	-0.003
	(0.038)	(0.038)	(0.02)	(0.014)	(0.011)
FF2	-0.044	-0.042*	-0.010	-0.007	-0.011
	(0.038)	(0.039)	(0.02)	(0.014)	(0.011)
	FRA1YBOND	FRA2YBOND	FRA3YBOND	FRA5YBOND	FRA10YBOND
FF1	-0.087**	-0.096**	-0.074**	-0.287*	-0.004
	(0.048)	(0.082)	(0.035)	(0.208)	(0.015)
FF2	-0.040	-0.066**	-0.097***	-0.015	0.029
	(0.048)	(0.076)	(0.035)	(0.201)	(0.015)
	FRA1YCDS	FRA2YCDS	FRA3YCDS	FRA5YCDS	FRA10YCDS
FF1	-0.014	-0.037*	-0.012	-0.015	-0.012
	(0.045)	(0.032)	(0.019)	(0.015)	(0.011)
FF2	-0.037	-0.043*	-0.006	0.000	0.003
	(0.045)	(0.042)	(-0.019)	(0.015)	(-0.011)
	ITA1YBOND	ITA2YBOND	ITA3YBOND	ITA5YBOND	ITA10YBOND
FF1	-0.039	-0.071**	-0.008	-0.007	-0.002
	(0.404)	(0.059)	(0.147)	(0.027)	(0.007)
FF2	-0.229	-0.092**	-0.009	-0.005	-0.002
	(0.403)	(0.070)	(0.147)	(0.027)	(0.007)
	ITA1YCDS	ITA2YCDS	ITA3YCDS	ITA5YCDS	ITA10YCDS
FF1	-0.019	-0.045**	-0.008	-0.011	0.006
	(0.019)	(0.016)	(0.014)	(0.011)	(0.009)
FF2	-0.010	-0.059**	-0.009	-0.011	0.009
	(0.019)	(0.016)	(0.014)	(0.011)	(0.009)
	SPA1YBOND	SPA2YBOND	SPA3YBOND	SPA5YBOND	SPA10YBOND
FF1	-0.039	-0.071**	-0.008	-0.007	-0.002
	(0.404)	(0.059)	(0.147)	(0.027)	(0.007)
FF2	-0.229	-0.092**	-0.009	-0.005	-0.002
	(0.403)	(0.070)	(0.147)	(0.027)	(0.007)
	SPA1YCDS	SPA2YCDS	SPA3YCDS	SPA5YCDS	SPA10YCDS
FF1	-0.019	-0.045**	-0.008	-0.011	0.006
	(0.019)	(0.016)	(0.014)	(0.011)	(0.009)
FF2	-0.010	-0.059**	-0.009	-0.011	0.009
	(0.019)	(0.016)	(0.014)	(0.011)	(0.009)

Note: Standard errors are shown in parentheses; GER means Germany, FRA means France, ITA means Italy, and SPA means Spain. *** denotes significance at 1 percent level, ** denotes significance at 5 percent level, * denotes significance at 10 percent level.